

### REMARKS

Claims 1-27 and 31 are pending in the application. Claims 20-27 have been withdrawn from consideration. Therefore, claims 1-27 and 31 are at issue.

The examiner still deems the restriction requirement as final based on the contention that the common technical feature of adding relatively large amounts of a clay to a superabsorbent polymer (SAP) during a surface crosslinking step lacks novelty. However, the claims also recite *additional* features. As discussed below in connection with the art-based rejections of claims 1-19, all pending claims 1-27, and new claim 31, have a common technical feature of adding *12% by weight* of a clay, or more, to SAP particles during a surface crosslinking process, which *is* novel and nonobvious. Accordingly, applicants again request that the examiner reconsider the restriction requirement, and rejoin and diaper method claims 20-27 for the reasons set forth herein and in the responses mailed November 22, 2005, March 14, 2006, and September 1, 2006, i.e., per PCT rules, unity is not lacking between claims of different categories having a common technical feature that is novel and nonobvious.

Claims 1, 2, 7-10, and 16 stand rejected under 35 U.S.C. §102(b) as being anticipated by WO 96/30442 (WO '442). The basis of this rejection is that WO '442 discloses the water-absorbent polymeric composition containing substantially unreactive water-insoluble particles, e.g., clay particles. For the reasons set forth below, it is submitted that the present claims are neither anticipated by nor obvious over WO '442.

The present claims recite *surface-crosslinked* superabsorbent particles containing 12% to 35%, by weight, of a clay *in the vicinity of the surfaces* of the superabsorbent particles. These feature are clearly and specifically set forth in claim 1 subparagraphs (ii), (iii)(d), and (iii)(e). As such, the claimed superabsorbent particles have a greater degree of crosslinking (which is at the surfaces of the particles as a result of surface crosslinking in addition to internal crosslinking) *and* the clay is positioned at the vicinity of the surfaces of the particles, i.e., are *not* distributed *throughout* the volume of a particle.

As recited in claim 1, in the present invention, the clay is added to dry SAP particles (claim 1, subparagraphs (iii)(c) and (iii)(d). Therefore, the clay is present in the vicinity of the particle surface *only*. The benefit of the present invention is that clay *on the surface* of superabsorbent particles enhances the fluid permeability of the particles and reduces the amount of fine-sized SAP particles.

As stated above, the superabsorbent particles of the present invention are surface crosslinked. Surface crosslinked polymer particles are internally crosslinked *during* polymerization to impart water insolubility, *and* surface crosslinked *after* polymerization and drying to improve absorption properties. Surface crosslinked SAP particles therefore have a higher level of crosslinking at the vicinity of particle surfaces compared to uniformly crosslinked particles, i.e., particles that are only internally crosslinked. The reference "Modern Superabsorbent Polymer Technology" illustrates this feature at page 97, figure 3.9, and is attached hereto as Exhibit A. Thus, the polymer particles according of the present invention are different from uniformly crosslinked particles.

The particles disclosed in WO '442 are substantially different from the presently claimed particles. In particular, WO '442 discloses the use of clay as filler (page 13, lines 1 to 3) to lower extractable levels and improve gel strength (page 13, lines 4 to 6). To achieve these benefits, the clay must be *homogeneously* distributed throughout the polymer particles (as opposed to being present only in the vicinity of the surfaces of the particles).

Example 4 of WO '442 clearly demonstrates that the clay is homogenously distributed throughout the particles. In Example 4, a non-crosslinked polymer (Isobam™) is mixed with an internal crosslinker (propylene carbonate) and a clay (Bentonite SD-2). The clay is used as a filler and is *homogeneously* distributed throughout the crosslinked Isobam™ polymer particles.

WO '442 discloses Isobam™ and cycloalkylene glycols as suitable copolymers and crosslinkers, respectively (page 7, line 21, to page 8, line 11), and also discloses the *need* of an *internal* crosslinking reaction (page 8, lines 12 to 14). The compounds, including the clay, must be *homogenously* mixed before crosslinking. Therefore, the clay in WO '442 is not present solely at the vicinity of the surfaces of the particles, but is distributed throughout the particle.

Additionally, WO '442 fails to teach or suggest any surface crosslinking. Accordingly, WO '442 merely discloses uniformly crosslinked particles only.

Because WO '442 fails to teach each and every feature recited in the claims, WO '442 cannot anticipate the present claims (MPEP §2131). In addition, the differences between the WO '442 disclosure and the present claims are nonobvious differences.

As stated above, WO '442 discloses particles having a clay distributed throughout the particles to improve gel strength and reduce extractables. WO '442 also fails to teach or suggest any surface crosslinking. In contrast the present claims recite surface crosslinked particles have a clay present in the vicinity of the particle surfaces. WO '442 fails to provide any motivation for a person skilled in the art to modify the WO '442 teachings in the radical manner required to arrive at the presently claimed invention. Furthermore, contrary to the examiner's contentions, WO '442 does not teach a "substantially identical" polymer to the claimed particles. WO '442 does *not* teach a surface crosslinking agent, and WO '442 teaches a substantially different process for producing superabsorbent particles, i.e., teaches a homogenous incorporation of the clay in the particle.

Accordingly, it is submitted that claims 1, 2, 7-10, and 16 are neither anticipated by, nor obvious over, WO '442, and that the rejection should be withdrawn.

Claims 1-5, 7-17, and 31 stand rejected under 35 U.S.C. §103 as being obvious over Sun et al. U.S. Patent No. 6,124,391 ('391) in view of WO '442. Claim 6 stands rejected under 35 U.S.C. §103 as being obvious over the '391 patent in view of WO '442. Claims 18 and 19 stand rejected under 35 U.S.C. §103 as being obvious over the '391 patent and WO '442 in view of Beerse et al. U.S. Patent Publication 2002/0006886 ('886). For the reasons set forth above, and for the reasons set forth below, it is submitted that these rejections are in error and should be withdrawn.

The '391 patent discloses the preparation of dried SAP particles, admixing the dried SAP particles with 0.2 to 10 wt% of an inorganic powder and a surface crosslinking agent (column 7, lines 27-32 and 43-45), and heating the resulting mixture. The inorganic powders can be a clay. The inorganic powder can be added to the SAP particles before, during, or after the surface crosslinking step. Importantly, the '391 patent specifically discloses that the clay is added to the SAP particles in an amount sufficient to achieve anticaking properties, up to a *maximum* of 10 wt%, and preferably *less* than 10 wt%, (see '391 patent, column 7, lines 27-32). Additionally, the examples of the '391 patent are SAP particles having a clay concentration of 0.5 to 3 wt%.

As stated above, the '391 patent is directed to incorporating an anticaking and dedusting amount of an inorganic powder to SAP particles. The *maximum* amount of inorganic powder added to the SAP particles, as disclosed in the '391 patent, is 10 wt%. In contrast the present claims specifically recite a *minimum* amount clay of 12%, by weight.

In addition, and as set forth in the Amendment of September 1, 2006 the differences between the '391 patent disclosure and present claims are nonobvious differences. The '391 patent discloses amounts of inorganic powder that typically are used in the art to impart anticaking and dedusting properties to SAP particles. The '391 patent contains no teaching or suggestion that would motivate a person skilled in the art to increase the amount of inorganic powder above the disclosed maximum limit of about 10%, by weight. In fact, persons skilled in the art would have had no incentive to increase the amount of inorganic powder above about 10 wt%, because the '391 patent teaches that dedusting is achieved at inorganic powder amounts well below 10 wt% (e.g., see '391 examples). Therefore, persons skilled in the art would consider using any amounts of clay above 10 wt% as being wasted.

However, applicants have found that including a clay in the surface crosslinking step, in the claimed amount of 12% to about 35%, by weight, provides the unexpected benefits of reducing the amount of fine-sized SAP particles *and* improving the permeability of the clay-treated SAP particles. See specification, page 7, lines 32-35, and page 8, lines 12-16, for example.

Applicants further have provided objective evidence demonstrating the new and unexpected results provided by the presently claimed invention. In each of Examples 5 and 6, at pages 30-33 of the specification, applicants provide a series of SAPs containing varying amounts of clay added to the SAP during the surface crosslinking step. Example 5, in the table at page 30, shows that an amount of clay disclosed in the '391 patent, i.e., 5% and 10 wt%, generates 20% and 16 wt%, respectively, of SAP particles having a diameter less than 200  $\mu\text{m}$  (i.e., fine-sized SAP particles). By increasing the amount of clay to 15 wt% in accordance with presently claimed invention, fine-sized particles having a diameter less than 200  $\mu\text{m}$  drops substantially to 4.5 wt%. Further increasing the amount of clay up to 35 wt% results in further decreases in the amount of fine-sized SAP particles.

The table of Example 5 also shows a substantial increase in fluid permeability in SAP particles having 15 wt% or more clay (inventive) over SAP particles having 5 wt% or 10 wt% clay (comparative and within the '391 disclosure). See SFC data in the table of Example 5. The importance of a high SFC value as relating to SAP particle permeability is discussed at page 28, line 17-26 of the specification. The table of Example 6 of the specification contains similar results with respect to both reducing the amount of fine-sized SAP particles and improving SAP particle permeability when a clay is present in an amount

recited in the claims. Notably, the SAP particles also performed well with respect to absorption properties even in the presence of high amounts of clay (see specification, page 33, lines 1-3 and AUL and CRC data in the tables of Examples 5 and 6).

Contrary to the examiner's statements in the Office Action, these results *are* unexpected in view of the teachings of the '391 patent, which are limited to a maximum of 10 wt% inorganic powder added to SAP particles to provide anticaking and dedusting properties. The '391 patent absolutely fails to teach or suggest using greater amounts of an inorganic powder for any purpose. The '391 patent teaches that the amount of clay to be used is typically about 0.2% to about 10%, more preferably about 0.5% to about 7%, and even more preferably about 0.9% to about 5.5%. The teaching of the '391 patent is that the *best* results can be expected in the *most preferred* range from 0.9% to 5.5%. Thus, one of ordinary skill in the art would not have been motivated to use clay in an amount substantially greater than that in the '391 patent disclosure. In fact, the '391 patent *discourages* increasing the amount of inorganic powder added to the SAP.

Persons skilled in the art certainly would have had no incentive from the '391 patent (directed to anticaking and dedusting) to increase the amount of clay added to SAP particles with any reasonable expectation of substantially reducing the amount of fine-sized SAP particles *and* improving SAP particle permeability, *while also* retaining SAP particle absorption properties.

WO '442 does not overcome the deficiencies of the '391 patent. First, WO '442 discloses particles substantially different from the presently claimed particles, as discussed above, i.e., clay distributed throughout the particle and no surface crosslinking. Second, after reading the '391 patent, a person skilled in the art would not have been motivated to increase the amount of clay to greater than 10%, as discussed above. Although the type of particle disclosed in WO '442 may be able to incorporate up to 25% clay (because the clay is distributed throughout the particle), it does not correlate to the amount of clay can be present in the type of particle disclosed in the '391 patent. In fact, the '391 patent discourages such an increase in the amount of clay at the surfaces of the particles.

Therefore, for the reasons set forth above, it is submitted that claims 1-17 would not have been obvious over the '391 patent in view of WO '442 under 35 U.S.C. §103.

With respect to claims 18 and 19, these are additional embodiments of the present invention and are patentable for the same reasons presented above for claims 1-17.

Furthermore, applicants maintain that the '886 publication does not overcome the deficiencies of the '391 patent and WO '442. The '886 publication merely discloses well known quaternary ammonium compounds (QACs). The QACs of the '886 publication are *not* incorporated into clay particles, but are added *directly* to "a water insoluble substrate comprising a nonwoven layer" (see paragraphs [0010], [0023] through [0051] and [0247]). A clay is *not* a nonwoven layer as disclosed in the '886 publication. The '886 patent fails to teach or suggest any combination of a QAC and a clay to provide an organophilic clay as required in claims 18 and 19, and furthermore the '886 publication is not remotely directed to SAP particles.

In fact, the QACs of the '886 publication are disclosed as optional, nonlathering cationic surfactants. The disclosure relating to QACs is nothing more than a general description of available QACs. At most, the '886 publication discloses that both an SAP and a QAC can be optional ingredients in a composition disclosed therein. There is no teaching that an SAP and a QAC should both be present, and no teaching or suggestion of including a clay. Furthermore, persons skilled in the art would not add a hydrophobic QAC to an SAP because the absorbency properties of the hydrophilic SAP would be adversely affected.

Therefore, persons skilled in the art would have had absolutely no motivation or incentive to consider combining any teaching from the nonanalogous '886 publication with the '391 patent and WO '442. Further, even if such a combination of references was considered, the combination would not lead a person skilled in the art to incorporate a standard QAC of the '886 publication (taught for use as a surfactant) into a clay (which ties up the QAC), then incorporate such a treated clay in the presently claimed amount into SAP particles during a surface-crosslinking step. Such jumps in reasoning to arrive at the presently claimed invention are not remotely suggested by the combination of the '391 patent, WO '442, and the '886 publication.

To support the rejection, the examiner relies upon a definition of the term "tallow." It is well known that a QAC can have a tallow component, but the '886 publication is limited to disclosing a QAC, not even remotely addressing an organophilic clay having a QAC component. An organophilic clay has properties different from an untreated clay because of the QAC. The QAC in the organophilic clay performs differently from a free QAC as disclosed in the '886 publication. The QAC in the '886 patent is used to provide a

nonlathering surfactant. In the present claims, the QAC is *not* available to act as a surfactant, but modifies the properties of the clay.

The examiner further misunderstands the claimed invention *vis-à-vis* the '886 publication by his statements in the first full paragraph of page 11 of the Office Action. The examiner's conclusory statement that it would have been obvious to "incorporate organophilic clay selected from tallow" into an SAP to obtain additional functional group linkages is totally incorrect. These hydroxyl and amino functionalities may be present in a composition of the '886 publication because the QAC is free, and is not bound to a clay. In an organophilic clay, the QAC is *bound* and is not available to provide any such functionalities. Further, if such functionalities were available, they may be detrimental and adversely affect the absorbency of the SAP particles.

Applicants reiterate that the '886 publication is nonanalogous art. The examiner previously admitted that the '886 publication is directed to a dry article for personal cleansing, and more generally to an article that *delivers* a compound having a benefit. An SAP does *not* deliver compounds, but rather absorbs aqueous solutions. The goal of the '886 patent teachings would be frustrated by using an SAP in place of the nonabsorbing nonwovens disclosed in the '886 patent. The SAP absorbs, whereas the nonwovens deliver.


For all the reasons set forth above, it is submitted that claims 1-19 and 31 would not have been obvious over the '391 patent in combination with WO '442, or in further combination with the '886 publication, and that the present rejections should be withdrawn. It also is submitted that claims 20-27 should be rejoined into the application because the common technical feature of all claims 1-27 and 31 is novel and nonobvious.

The pending claims are in a form and scope for allowance. An early and favorable action on the merits is respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form in an effort to advance this application toward allowance, the examiner is urged to telephone the undersigned at the indicated number.

Dated: December 11, 2006

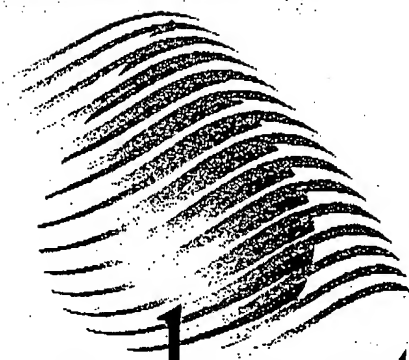
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Exhibit A



# Modern Superabsorbent Polymer Technology

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### 3.2.8. Addition of Post-Treatments

**3.2.8.1. Advanced Products.** The processes described above produce a particle with crosslinking that may be assumed to be essentially uniform throughout the particle. As such, the swelling and modulus behavior of the product particles can be described by theories of network swelling and elasticity (see Chapter 5). One problem associated with these superabsorbent polymers was also recognized in a variety of water soluble polymers, e.g., poly(acrylamide), cellulose ethers,<sup>95</sup> or soluble poly(acrylic acid).<sup>96</sup> This problem is the tendency of the granular polymers to clump, "gel block," or form fish-eyes when aqueous liquids are added to them or they are added to aqueous liquids. The surfaces of the massed particles swell rapidly to form a soft, deformable layer. The resulting particle deformation and interparticle adhesion reduces interparticle porosity and limits the swelling rate of the polymer mass to the diffusion rate of liquid through the partially swollen mass.

The first attempts to solve this problem in highly absorbent anionic polyelectrolytes used multivalent cations to form a crosslinked surface layer that was more rigid than the original core polymer.<sup>97</sup> Subsequently, to give products with improved dispersibility and absorption rate, the surface of crosslinked polyacrylate particles was reacted with a variety of multifunctional organic compounds.<sup>49,50,98,99</sup> This structural improvement is shown schematically in Figure 3.9. Swelling capacity data as a function of particle size readily demonstrate that a shell of real, as opposed to infinitesimal, thickness is formed by surface crosslinking processes. The shell of higher crosslink density provides a more rigid surface layer during swelling and prevents the gel-blocking that would otherwise occur early in the swelling process (Chapter 5). As a result, liquid can flow through the bed of particles to each particle, increasing the effective surface area available for swelling and the apparent swelling rate. The swelling and modulus behavior of structured particles are discussed in Chapter 5.

Because a surface layer is formed on each individual particle, the crosslinking reaction, but not necessarily the reagent addition, must occur after achieving the desired particle size distribution. Any compound that can react with two or more functional groups on the polymer backbone can function as a surface crosslinking reagent. For superabsorbents, this requires reagents that can react with the car-

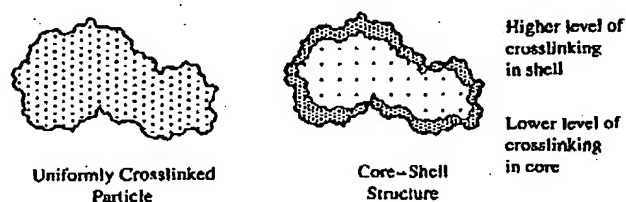


Figure 3.9. Schematic representation of a uniformly crosslinked superabsorbent particle and a structured particle with a surface layer of higher crosslink density.